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Complex Magnetic Phase Diagram of $CeRh_2Ge_2$

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It has been reported that the intermetallic compound $CeRh_2Ge_2$ with the tetragonal $ThCr_2Si_2$ structure exhibits an incommensurate antiferromagnetic ordering below the Néel temperature of 15 K*. Recent researches have revealed that another transition is observed in the specific heat at 8.3 K. Magnetic isotherm measurements at 5 K using polycrystalline specimens have shown that double-step metamagnetic transition occurs at 0.5 T and 3 T†. In order to obtain precise information about the magnetic properties of $CeRh_2Ge_2$, we have performed a series of magnetization measurements on the home-made single crystalline specimens up to 5 T and down to 2 K. Consequently, it was found that the magnetic phase diagram along the c-axis is quite complicated. Magnetic susceptibility measured at 0.1 T indicates two transitions occur at 8.25 and 14.4 K. The magnetic isotherm at 2 K shows 5-step metamagnetic transitions at 0.35 (Hc_1), 2.33 (Hc_2), 2.47 (Hc_3), 3.19 (Hc_4) and 3.45 T (Hc_5). Magnetization at each plateau is 0 ($H < Hc_1$), 0.12 ($Hc_1 < H < Hc_2$), 0.31 ($Hc_2 < H < Hc_3$), 0.50 ($Hc_3 < H < Hc_4$), 0.88 ($Hc_4 < H < Hc_5$) and reaches to the saturation magnetization 1.81 μ_B/f.u. above Hc_5. The H-T plane is divided into 8 sections by the phase boundaries. Such complexity of the phase diagram suggests a frustration in the exchange interactions between the highly anisotropic magnetic moments.

*G.Venturini et.al., Solid State Commun. 67(1988)193.
†J.D.Thompson et.al., Physica B 199 and 200(1994)589.